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Influence of livestock markets on the spread of FMD

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The purpose of this study was to investigate, whether cattle markets would influence the duration, size and economic consequences of a potential FMD epidemic in Denmark.

The spread of FMD was simulated using the InterSpread Plus. For movements of cattle to and from markets, we modeled the frequency of movements to markets for the individual herd and categorized herds that could receive contacts from markets. The epidemics were initiated in herds with market contacts. In a basic market scenario, we used the individual herds' probability of moving animals to markets, while in a control scenario we reduced all probabilities of movements to markets to zero, to reflect a situation with no markets. Each scenario was initiated in 386 different herds (index), and for each index herd, the model was run 100 times. The number of extra contacts generated through a market was set to 3.5 and the probability of transmission from markets was modeled as a normal distribution with a mean of 0.415 and a standard deviation of 0.06. This probability was a combination of the risk from purchase of animals from markets and the indirect contact from visitors on markets. Danish markets would be closed as soon as FMD is detected. Therefore, markets were only active during the first three weeks of the epidemic, as time from infection to first detection was assumed to be 21 days.

Results are presented as medians and 5-95 percentiles (brackets).

Simulated scenario	Epidemic duration (days[1)]	Number of detected herds	Number of depopulated herds	Size of infected area (1000 km²)	Direct costs (million €)	Indirect costs (million €)
With markets	90 (9-262)	161 (4-631)	194 (5-754)	14.3 (0-37.5)	37.5 (6.8-126.7)	629.6 (375.7-1166.7)
Without markets	87 (8-262)	144 (3-612)	173 (4-731)	9.8 (0-35.6)	33.9 (6.5-124.7)	613.8 (370.5-1161.8)

[1] Epidemic duration calculated from day of first detection to the last herd is detected.

The results show an effect of markets on the size, duration and costs of a FMD epidemic (Table 1); the median duration of epidemics is 1 week longer, and 28 more herds are detected with FMD. In the scenarios with markets, the epidemics included a larger area compared to scenarios without markets. It is also shown that epidemics with markets are more expensive compared to epidemics without markets.